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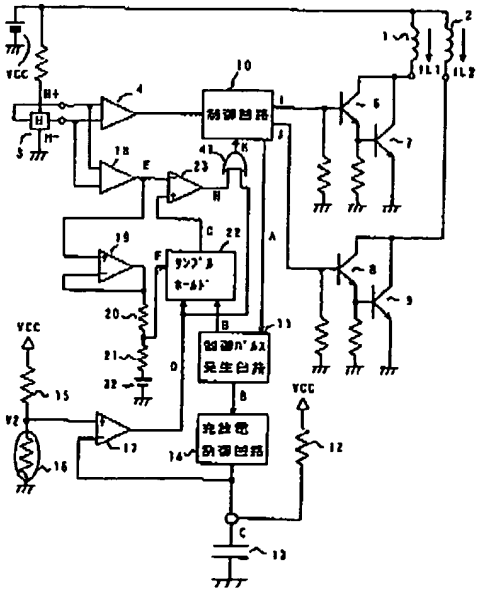
(54)【発明の名称】　モータ駆動回路

(57)【要約】
【課題】　モータの振動音、駆動効率低下を抑える。
【解決手段】　ホール素子３の正弦波信号を全波変換した全波信号Ｅと、全波信号Ｅを減衰させた減衰信号Ｆを第１比較信号Ｄの立下りでサンプルホールドし且つ立上りで零とする台形波信号Ｇとを比較器２３で比較して第２比較信号Ｈを出力し、第１及び第２比較信号Ｄ、ＨをＯＲ回路４１で加算して加算信号Ｋを出力する。これより、駆動コイル１，２の相切り換え点の前後半近傍で、駆動コイル１，２に駆動電流ＩＬは流れなくなる。相切り換え点の前半近傍では、駆動電流ＩＬを逆起電圧Ｅｃが小さくなる前に零とできる為、モータを静音化できる。また、相切り換え点の後半近傍では、駆動電流ＩＬを前半近傍から引き続き零とできる為、モータの駆動効率低下を防止できる。減衰信号Ｆから台形波信号Ｇを作る為、相切り換え点の前半近傍に駆動電流ＩＬを零とできる期間を必ず設けることができる。



1

【特許請求の範囲】

【請求項１】 モータを構成するステータ及びロータの相対的位置関係に応じてホール素子が発生する正弦波信号に基づいて、第１コイル及び第２コイルを相補的に駆動する第１駆動トランジスタ及び第２駆動トランジスタを有するモータ駆動回路において、

前記第１及び第２コイルの駆動時に一方向に変化し且つ前記第１及び第２コイルの相切り換え時に他方向に変化する鋸歯状波信号と基準電圧とを比較し、前記第１及び第２コイルの相切り換え点の前半近傍又は後半近傍で第１駆動オフ信号を発生する手段と、

前記正弦波信号を全波変換した全波信号と、前記全波信号を減衰させた減衰信号を前記第１駆動オフ信号のタイミングでサンプルホールドしたサンプルホールド信号とを比較し、前記第１及び第２コイルの相切り換え点における前記第１駆動オフ信号が発生しない側の近傍で第２駆動オフ信号を発生する手段と、

前記第１及び第２駆動オフ信号を加算し、前記第１及び第２コイルの相切り換え点の前後半近傍で前記第１及び第２駆動トランジスタを同時オフさせる信号を出力する手段と、

を備えたことを特徴とするモータ駆動回路。

【請求項２】 モータを構成するステータ及びロータの相対的位置関係に応じてホール素子が発生する正弦波信号に基づいて、第１コイル及び第２コイルを相補的に駆動する第１駆動トランジスタ及び第２駆動トランジスタを有するモータ駆動回路において、

前記正弦波信号に基づいて、前記第１及び第２コイルの駆動を切り換えるタイミングで制御パルスを発生する制御パルス発生回路と、

所定時定数に従って充電を行い前記制御パルスが供給された時点で放電を行い鋸歯状波信号を発生する鋸歯状波信号発生回路と、

前記鋸歯状波信号と前記鋸歯状波信号の最小電圧より高い基準電圧とを比較し、前記鋸歯状波信号が放電された時点から所定幅だけ一方側の論理レベルの第１駆動オフ信号を出力する第１比較回路と、

前記正弦波信号の絶対値信号の減衰信号に対し、前記第１駆動オフ信号の終端でサンプルホールドを行いその時の振幅を保持し、その後、前記第１駆動オフ信号の始端で前記保持振幅を零とすることにより台形波信号を出力するサンプルホールド回路と、

前記絶対値信号と前記台形波信号とを比較し、前記鋸歯状波信号が放電される時点より前に所定幅だけ一方側の論理レベルの第２駆動オフ信号を出力する第２比較回路と、

前記第１及び第２駆動オフ信号を加算し、前記第１及び第２コイルの相切り換え点の前後半近傍で前記第１及び第２駆動トランジスタを同時オフさせる為の信号を出力する加算回路と、

2

を備えたことを特徴とするモータ駆動回路。

【発明の詳細な説明】

【０００１】

【発明の属する技術分野】本発明は、ファンの静音化の為のモータ駆動回路に関する。

【０００２】

【従来の技術】図５は従来のモータ駆動回路を示す回路ブロック図である。

【０００３】図５において、駆動コイル（１）（２）は、構造上はモータを構成するステータ側に固着され、配線上は一端が電源ＶＣＣを介して接地され、電気角１８０度毎に駆動電流ＩＬ１、ＩＬ２が相補的に流れるものである。ホール素子（３）は、構造上はモータを構成するステータ側の所定位置に固着され、配線上は電源ＶＣＣと接地との間に接続されて電源が供給され、ステータ及びロータの相対的位置関係に応じて各々逆相の正弦波信号Ｈ＋、Ｈ－を出力するものである。増幅器（４）は正弦波信号Ｈ＋と逆相の正弦波信号Ｈ－とを比較し、矩形波信号を出力するものである。制御回路（５）は、増幅器（４）から出力される矩形波信号Ａを基に逆相の矩形波信号Ｂを作成し、両方の矩形波信号Ａ，Ｂを電流増幅した後に出力するものである。ＮＰＮ型トランジスタ（６）（７）はダーリントン接続された状態で駆動コイル（１）の他端と接地との間に接続され、ＮＰＮ型トランジスタ（６）のベースに矩形波信号Ａのハイレベルが供給された時、ＮＰＮ型トランジスタ（６）（７）がオンして駆動コイル（１）に駆動電流ＩＬ１を流すものである。同様に、ＮＰＮ型トランジスタ（８）（９）はダーリントン接続された状態で駆動コイル（２）の他端と接地との間に接続され、ＮＰＮ型トランジスタ（８）のベースに矩形波信号Ｂのハイレベルが供給された時、ＮＰＮ型トランジスタ（８）（９）がオンして駆動コイル（２）に駆動電流ＩＬ２を流すものである。そして、駆動電流ＩＬ１，ＩＬ２が駆動コイル（１）（２）に交互に流れることによりモータは回転する。

【０００４】

【発明が解決しようとする課題】図６は前記駆動電流ＩＬ１，ＩＬ２を示す波形図である。駆動電流ＩＬ１．ＩＬ２（＝ＩＬ）は次式で表される。

【０００５】ＩＬ＝（ＶＣＣ－Ｖｓａｔ－Ｅｃ）／ＲＬ

但し、ＶＣＣ……電源電圧

Ｖｓａｔ…駆動トランジスタ（７）（９）の飽和電圧

Ｅｃ……逆起電圧

ＲＬ……駆動コイル（１）（２）の抵抗成分

さて、モータの回転中において、駆動電流ＩＬ１，ＩＬ２を切り換える相切り換え点の直前近傍Ｔでは、逆起電圧Ｅｃが小さくなる為、駆動電流ＩＬは大きくなる。しかし、相切り換え点の直前近傍Ｔでの駆動電流ＩＬでは、元々モータの回転トルク発生効率が悪く、駆動電流ＩＬの大きさが災いして駆動電流ＩＬの急激な変化に伴

いモータの回転トルクが変動してモータの振動音を誘発する問題があった。また、相切り換えと同時に駆動コイル（１）（２）に駆動電流ＩＬ１．ＩＬ２を流すと、無効電流が影響してモータの駆動効率を抑制する要因となる問題があった。

【０００６】そこで、本発明は、モータの静音化と駆動効率向上を実現するモータ駆動回路を提供することを目的とする。

【０００７】

【課題を解決するための手段】本発明は、前記問題点を解決する為に創作されたものであり、モータを構成するステータ及びロータの相対的位置関係に応じてホール素子が発生する正弦波信号に基づいて、第１コイル及び第２コイルを相補的に駆動する第１駆動トランジスタ及び第２駆動トランジスタを有するモータ駆動回路において、前記第１及び第２コイルの駆動時に一方向に変化し且つ前記第１及び第２コイルの相切り換え時に他方向に変化する鋸歯状波信号と基準電圧とを比較し、前記第１及び第２コイルの相切り換え点の前半近傍又は後半近傍で第１駆動オフ信号を発生する手段と、前記正弦波信号を全波変換した全波信号と、前記全波信号を減衰させた減衰信号を前記第１駆動オフ信号のタイミングでサンプルホールドしたサンプルホールド信号とを比較し、前記第１及び第２コイルの相切り換え点における前記第１駆動オフ信号が発生しない側の近傍で第２駆動オフ信号を発生する手段と、前記第１及び第２駆動オフ信号を加算し、前記第１及び第２コイルの相切り換え点の前後半近傍で前記第１及び第２駆動トランジスタを同時オフさせる信号を出力する手段と、を備えたことを特徴とする。

【０００８】また、モータを構成するステータ及びロータの相対的位置関係に応じてホール素子が発生する正弦波信号に基づいて、第１コイル及び第２コイルを相補的に駆動する第１駆動トランジスタ及び第２駆動トランジスタを有するモータ駆動回路において、前記正弦波信号に基づいて、前記第１及び第２コイルの駆動を切り換えるタイミングで制御パルスを発生する制御パルス発生回路と、所定時定数に従って充電を行い前記制御パルスが供給された時点で放電を行い鋸歯状波信号を発生する鋸歯状波信号発生回路と、前記鋸歯状波信号と前記鋸歯状波信号の最小電圧より高い基準電圧とを比較し、前記鋸歯状波信号が放電された時点から所定幅だけ一方側の論理レベルの第１駆動オフ信号を出力する第１比較回路と、前記正弦波信号の絶対値信号の減衰信号に対し、前記第１駆動オフ信号の終縁でサンプルホールドを行いその時の振幅を保持し、その後、前記第１駆動オフ信号の始縁で前記保持振幅を零とすることにより台形波信号を出力するサンプルホールド回路と、前記絶対値信号と前記台形波信号とを比較し、前記鋸歯状波信号が放電される時点より前に所定幅だけ一方側の論理レベルの第２駆動オフ信号を出力する第２比較回路と、前記第１及び第２駆動オフ信号を加算し、前記第１及び第２コイルの相切り換え点の前後半近傍で前記第１及び第２駆動トランジスタを同時オフさせる為の信号を出力する加算回路と、を備えたことを特徴とする。

【０００９】

【発明の実施の形態】本発明の詳細を図面に従って具体的に説明する。

【００１０】図１は本発明のモータ駆動回路を示す回路ブロック図である。尚、図１の中で図５と同じ素子には同じ番号を記しその説明を省略する。また、図２は図１の動作を示す波形図である。

【００１１】図１において、制御回路（１０）は増幅器（４）から出力された正弦波信号を矩形波信号Ａに波形変換するものである。制御パルス発生回路（１１）は、矩形波信号Ａが供給され、矩形波信号Ａの立上り時点及び立下り時点で制御パルスＢを発生するものである。抵抗（１２）及びコンデンサ（１３）は時定数回路を構成し、抵抗（１２）の抵抗値及びコンデンサ（１３）の容量に従って充電を行う。充放電制御回路（１４）は、制御パルス発生回路（１１）と接続され、制御パルスＢが供給された時、コンデンサ（１３）の蓄積電荷を放電するものである。尚、放電時、コンデンサ（１３）の蓄積電荷の最小値は電圧Ｖ１に制限され、電圧Ｖ１未満となることはない。従って、抵抗（１２）及びコンデンサ（１３）の接続点からは相切り換え毎に最小電圧Ｖ１まで放電を行う鋸歯状波信号Ｃが発生する。抵抗（１５）及びサーミスタ（１６）は電源ＶＣＣと接地との間に直列接続され、接続中点から電圧Ｖ１より高い電圧Ｖ２を発生する。第１比較器（１７）は鋸歯状波信号Ｃと電圧Ｖ２とを比較する。即ち、第１比較器（１７）は、電圧Ｖ２が鋸歯状波信号Ｃより高い期間はハイレベルとなり、電圧Ｖ２が鋸歯状波信号Ｃより低い期間はローレベルとなる第１比較信号Ｄ（第１駆動オフ信号）を出力する。第１比較信号Ｄのハイレベル期間は、サーミスタ（１６）の周囲温度が高いほど短く且つ低いほど長くなる。

【００１２】絶対値回路（１８）はホール素子（３）が出力する正弦波信号Ｈ＋、Ｈ－に対し振幅中点を境に絶対値を取った絶対値信号Ｅを出力する。増幅器（１９）は抵抗（２０）（２１）の抵抗値で定まる減衰率で絶対値信号Ｅを減衰させた減衰信号Ｆを出力する。絶対値信号Ｅ及び減衰信号Ｆは基準電源（３２）により共通の直流バイアスが与えられる。尚、減衰信号Ｆは、後述するサンプルホールド回路に制御パルスＢ及び比較信号Ｄが作用しない場合の波形である。サンプルホールド回路（２２）は、減衰信号Ｆを比較信号Ｄの立下りでサンプルホールドして保持し、その後、減衰信号Ｆを比較信号Ｄの立上りで絶対値信号Ｅの最小電圧まで下降させた台形波信号Ｇを出力するものである。第２比較器（２３）は絶対値信号Ｅと台形波信号Ｇとを比較し、台形波信号

Ｇが絶対値信号Ｅより高い期間はハイレベルとなり、台形波信号Ｇが絶対値信号Ｅより低い期間はローレベルとなる第２比較信号Ｈ（第２駆動オフ信号）を出力する。第２比較信号Ｈは、駆動コイル（１）（２）の相切り換え前の所定幅だけ発生する。ＯＲ回路（４１）は第１比較信号Ｄと第２比較信号Ｈとを加算し、駆動コイル（１）（２）の相切り換え点の前後半近傍で第１及び第２駆動トランジスタ（７）（９）を同時オフする為の加算信号Ｋを出力するものである。尚、第１及び第２比較信号Ｄ、Ｈを加算した場合、第１比較信号Ｄの立上り及び第２比較信号Ｈの立下りが制御パルスＢを基準にしている為、第１比較信号Ｄの立上り及び第２比較信号Ｈの立下りの接合点でチャタリングが起こることは無い。制御回路（１０）は加算信号Ｋが供給され、加算信号Ｋを基に、第１駆動トランジスタ（７）をオンする為の第１駆動信号Ｉと第２駆動トランジスタ（９）をオンする為の第２駆動信号Ｊを出力する。これより、駆動コイル（１）（２）には駆動電流ＩＬ１，ＩＬ２が流れ、モータは回転する。

【００１３】以上より、

（ａ）相切り換え点の前半近傍においては、駆動電流ＩＬ１，ＩＬ２を逆起電圧Ｅｃが小さくなる影響を受ける前に零とできる為、駆動電流ＩＬ１，ＩＬ２が高いレベルから急激に立下る不都合を防止でき、モータの静音化が可能となる。

【００１４】（ｂ）ホール素子（３）の特性ばらつきに伴い正弦波信号Ｈ＋、Ｈ－の振幅が変動した場合、或いは、モータの回転速度に変化に伴い正弦波信号Ｈ＋、Ｈ－の周期が変動した場合であっても、相切り換え点の前後半近傍での第１及び第２駆動トランジスタ（７）（９）の同時オフ期間を一定とでき、駆動電流ＩＬの急峻な立上りを防止できる為、可変速モータの静音化に適する。

【００１５】（ｃ）相切り換え点の後半近傍においては、前半近傍から引き続き駆動電流ＩＬ１，ＩＬ２を零とできる為、無効電流を無視できモータの駆動効率の低下を防止できる。

【００１６】（ｄ）減衰信号Ｆから台形波信号Ｇを作成する為、第１比較信号Ｄの幅が周囲温度変化に伴うサーミスタ（１６）の抵抗値変化の影響を受けても、第２比較信号Ｈは必ず発生し、モータの回転トルクの変動及びそれに伴う騒音の発生を防止できる。

【００１７】といった作用効果を奏する。

【００１８】さて、図１の鋸歯状波信号Ｃ、台形波信号Ｇに関し、一実施回路を用いて信号出力動作を説明する。

【００１９】図３は充放電制御回路（１４）の一実施例を示す回路図である。図３はトランジスタ（２４）のオンオフに応じて互いに同電位のトランジスタ（２５）のベース電圧及びトランジスタ（２６）のエミック電圧を変動させるものである。

【００２０】図３において、制御パルスＢが発生しない時、トランジスタ（２４）がオフし、トランジスタ（２５）のベース電圧及びトランジスク（２６）のエミッタ電圧はは電源ＶＣＣから抵抗（２８）の両端電圧を減算した電圧Ｖｍａｘとなる。従って、コンデンサ（１３）は抵抗（１２）の抵抗値及びコンデンサ（１３）の容量で定まる時定数で充電を行い、コンデンサ（１３）の端子電圧は上昇する。尚、制御パルスＢの発生周期はモータの回転数に応じて変化するが、前記時定数は、コンデンサ（１３）の充電電圧が制御パルスＢの発生周期の途中で電圧Ｖｍａｘに達することのない値に設定される。一方、制御パルスＢが発生した時、トランジスタ（２４）がオンし、トランジスタ（２５）のベース電圧及びトランジスタ（２６）のエミッタ電圧は抵抗（２８）（２９）の分圧電圧Ｖ１（＜Ｖｍａｘ）となる。この時、コンデンサ（１３）の非接地側電圧は電圧Ｖ１より高い為、コンデンサ（１３）の蓄積電荷はトランジスタ（２７）を介して電圧Ｖ１まで放電される。この動作を繰り返し、鋸歯状波信号Ｃが発生する。図４は増幅器（１９）、サンプルホールド回路（２２）、比較器（２３）の一実施例を示す回路図である。

【００２１】図４において、増幅器（１９）は絶対値信号Ｅの入力部に抵抗（３１）及び基準電圧（３２）から成る直列体を設けている。従って、電流で表された絶対値信号Ｅは最小電圧Ｖ３を基準に抵抗（３１）で電圧変換される。電圧変換された絶対値信号Ｅは内部の逆動増幅回路、電流ミラー回路を介して抵抗（２０）（２１）の各抵抗値Ｒａ，Ｒｂで決定する減衰率Ｒｂ／（Ｒａ＋Ｒｂ）で減衰され、減衰信号Ｆとなる。ここで、増幅器（１９）の出力と比較器（２３）の入力との間にはサンプルホールド回路（２２）が介在する。サンプルホールド回路（２２）において、制御パルスＢが発生するとＮＰＮ型トランジスタ（３３）がオンし、コンデンサ（３４）の蓄積電荷は放電される。この時、第１比較信号Ｄは制御パルスＢが発生してから鋸歯状波信号Ｃが電圧Ｖ２を超えるまでハイレベルとなる為、トランジスタ（３５）がオン、トランジスタ（３６）がオフし、コンデンサ（３４）はダイオード（３７）を介して充電を行う。その後、第１比較信号Ｄがローレベルに変化すると、トランジスタ（３５）がオフ、トランジスク（３６）がオンする為、電流源（３８）の全電流はトランジスタ（３６）のコレクタエミッタ路を流れ、コンデンサ（３４）は充電を停止しコンデンサ（３４）の端子電圧は保持された状態となる。尚、ダーリントン接続されたトランジスタ（３９）（４０）は、コンデンサ（３４）が電圧保持状態の時、蓄積電荷の放電量を最小限に抑える為のものである。これより、台形波信号Ｇが発生する。

【００２２】

【発明の効果】本発明によれば、第１及び第２コイルの

相切り換え点の前半近傍においては、コイル電流を逆起電圧が小さくなる影響を受ける前に零とできる為、コイル電流が高いレベルから急激に立下る不都合を防止でき、モータの静音化が可能となる。また、ホール素子の特性ばらつきに伴い正弦波信号の振幅が変動した場合、或いは、モータの回転速度に変化に伴い正弦波信号の周期が変動した場合であっても、相切り換え点の前後半近傍での第１及び第２駆動トランジスタの同時オフ期間を一定とでき、コイル電流の急峻な立上りを防止できる為、可変速モータの静音化に適する。また、相切り換え点の後半近傍においては、前半近傍から引き続きコイル電流を零とできる為、無効電流を無視できモータの駆動効率の低下を防止できる。

【図面の簡単な説明】

【図１】本発明のモータ駆動回路を示す回路ブロック図である。

【図２】図１の各部波形を示す波形図である。

【図３】図１の鋸歯状波信号の発生回路の具体例を示す回路図である。

【図４】図１の台形波信号の発生回路の具体例を示す回路図である。

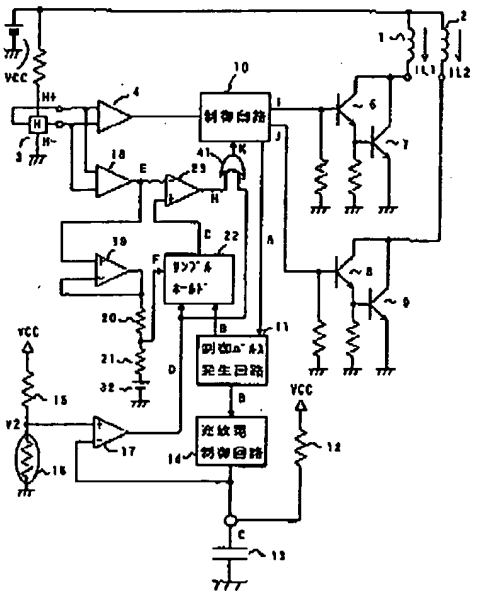
【図５】従来のモータ駆動回路を示す回路ブロック図である。

【図６】図５のコイル電流波形を示す波形図である。

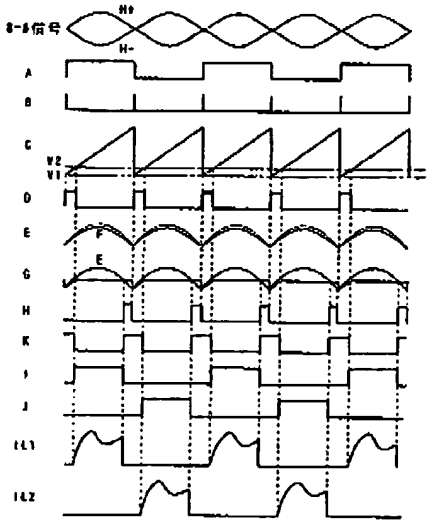
【符号の説明】

（１）（２）　駆動コイル
（３）　ホール素子
（７）（９）　駆動トランジスタ
（１０）　制御回路
（１１）　制御パルス発生回路
（１４）　充放電制御回路
（１７）　第１比較器
（１９）　増幅器
（２２）　サンプルホールド回路
（２３）　第２比較器
（４１）　ＯＲ回路

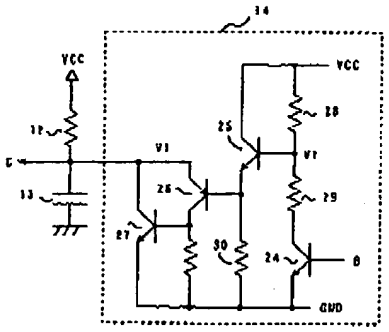
【図１】



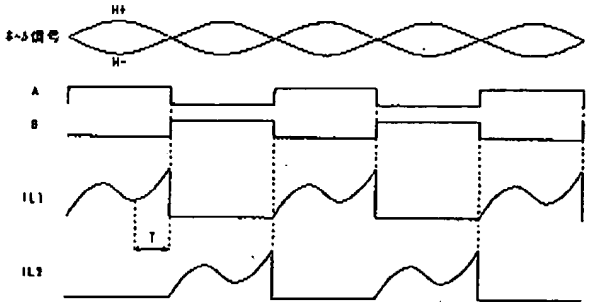
【図２】



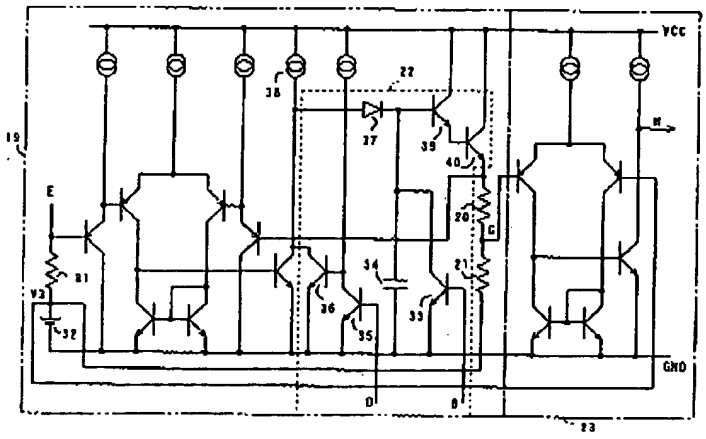
【図３】


14
VCC
VCC
18
25
28
V1
V1
26
29
27
30
24
B
GND
C
13

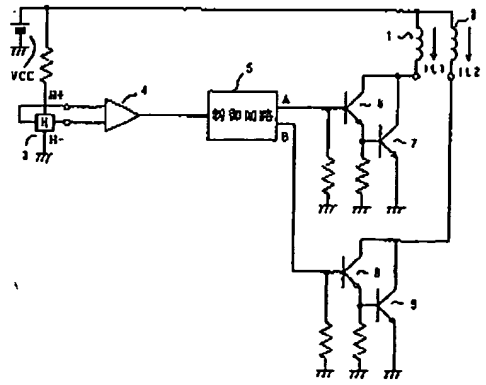
【図６】


H+
H-
A
B
IL1
IL2
T

【図４】


VCC
22
38
27
39
40
H
19
E
20
C
21
31
B1
V3
32
36
35
33
GND
D
B
23

【図５】


VCC
H+
H-
4
5
A
B
1
3
IL1
IL2
6
7
8
9

PATENT ABSTRACTS OF JAPAN

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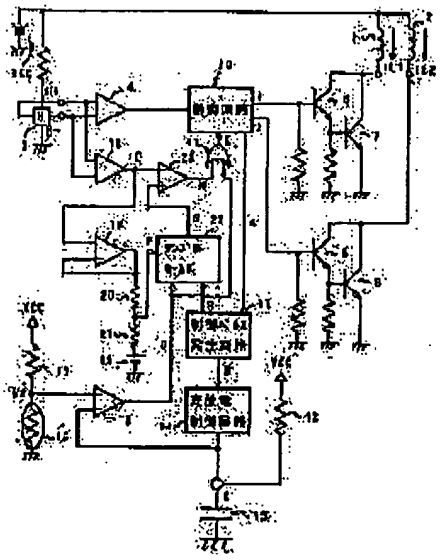
SOMEYA TAKASHI

(54) MOTOR DRIVE CIRCUIT

(57)Abstract:
PROBLEM TO BE SOLVED: To suppress the vibration noise of a motor and the drive efficiency from lowering.
SOLUTION: A comparator 23 compares a full-wave signal E obtained by full-wave converting a sine wave signal from a Hall element 3, with a trapezoidal signal G obtained by sampling and holding an attenuated signal F of the full-wave signal E at the fall of a first comparison signal D and bringing the attenuated signal at the rise of the first comparison signal D for producing a second comparison signal H. The first and second comparison signals D, H are then added by an OR circuit 41 to produce a sum signal K. Consequently, a drive current IL does not flow through drive coils 1, 2 in the vicinity of first and second halves of the phase switching point thereof. Since the drive current IL can be brought to zero before the counter electromotive force Ec is decreased in the vicinity of first half of the phase switching point, a motor can be quiet down. Furthermore, since the drive current IL can be sustained at zero level from the vicinity of first half of the phase switching point, drive efficiency of the motor can be prevented from lowering. Since with a trapezoidal signal G can be generated from an attenuated signal F, an interval for bringing the drive current IL to zero can be provided in the vicinity of first half of the phase switching point without fail.



LEGAL STATUS

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[Kind of final disposal of application other than the examiner's decision of rejection or application converted registration]

[Date of final disposal for application]

[Patent number]

[Date of registration]

[Number of appeal against examiner's decision of rejection]
[Date of requesting appeal against examiner's decision of rejection]
[Date of extinction of right]

* NOTICES *

1.This document has been translated by computer. So the translation may not reflect the original precisely.
2.**** shows the word which can not be translated.
3.In the drawings, any words are not translated.

DESCRIPTION OF DRAWINGS

[Brief Description of the Drawings]
[Drawing 1] It is the circuit block diagram showing the motorised circuit of this invention.
[Drawing 2] It is the wave form chart showing each part wave of drawing 1 .
[Drawing 3] It is the circuit diagram showing the example of the generating circuit of the saw-tooth wave signal of drawing 1 .
[Drawing 4] It is the circuit diagram showing the example of the generating circuit of the trapezoidal wave signal of drawing 1 .
[Drawing 5] It is the circuit block diagram showing the conventional motorised circuit.
[Drawing 6] It is the wave form chart showing the coil current wave form of drawing 5 .
[Description of Notations]
(1) (2) Drive coil
(3) Hall device
(7) (9) Actuation transistor
(10) Control circuit
(11) Control pulse generating circuit
(14) Charge-and-discharge control circuit
(17) The 1st comparator
(19) Amplifier
(22) Sample hold circuit
(23) The 2nd comparator
(41) OR circuit

[Translation done.]

CLAIMS

[Claim(s)]
[Claim 1] It is based on the sinusoidal signal which a hall device generates according to the stator which constitutes a motor, and the relative location of Rota. In the motorised circuit which has the 1st actuation transistor and the 2nd actuation transistor which drive the 1st coil and the 2nd coil complementary The saw-tooth wave signal and reference voltage which change to an one direction at the time of actuation of said 1st and 2nd coils, and change in the other directions at the time of a phase switch of said 1st and 2nd coils are compared. A means to generate the 1st actuation off signal in near the second half near the first half of the point of said 1st and 2nd coils switching [phase], The full wave signal which carried out full wave conversion of said sinusoidal signal is compared with the sample hold signal which carried out sample hold of the attenuation signal which attenuated said full wave signal to the timing of said 1st actuation off signal. A means to generate the 2nd actuation off signal near the side which said 1st actuation off signal in the point of said 1st and 2nd coils switching [phase] does not generate, The motorised circuit characterized by having a means to output the signal which said 1st and 2nd actuation off signal is added [signal], and carries out simultaneous OFF of said 1st and 2nd actuation transistor near the switching [phase] point order half of said 1st and 2nd coils.
[Claim 2] It is based on the sinusoidal signal which a hall device generates according to the stator which constitutes a motor, and the relative location of Rota. In the motorised circuit which has the 1st actuation transistor and the 2nd actuation transistor which drive the 1st coil and the 2nd coil complementary The control pulse generating circuit which generates a control pulse to the timing which switches actuation of said 1st and 2nd coils based on said sinusoidal signal, The saw-tooth wave signal generating circuit which discharges when it charges according to a predetermined time constant and said control pulse is supplied, and generates a saw-tooth wave signal, The 1st comparison circuit where only predetermined width of face outputs the 1st actuation off signal of the logical level of one side from the event of comparing reference voltage higher than the minimum electrical potential difference of said saw-tooth wave signal and said saw-tooth wave signal, and said saw-tooth wave signal discharging, To the attenuation signal of the absolute value signal of said sinusoidal signal, perform sample hold by **** of said 1st actuation off signal, and the amplitude at that time is held. Then, the sample hold circuit which outputs a trapezoidal wave signal by making said maintenance amplitude into zero by **** of said 1st actuation off signal, The 2nd comparison circuit where only predetermined width of face outputs the 2nd actuation off signal of the logical level of one side before the event of comparing said absolute value signal and said trapezoidal wave signal, and said saw-tooth wave signal discharging, The motorised circuit characterized by having the adder circuit which outputs the signal for adding said 1st and 2nd actuation off signal, and carrying out simultaneous OFF of said 1st and 2nd actuation transistor near the switching [phase] point order half of said 1st and 2nd coils.

[Translation done.]

DETAILED DESCRIPTION

[Detailed Description of the Invention]
[0001]
[Field of the Invention] This invention relates to the motorised circuit for silence of a fan.
[0002]
[Description of the Prior Art] Drawing 5 is the circuit block diagram showing the conventional motorised circuit.
[0003] In drawing 5 , a structure top fixes a drive coil (1) and (2) to the stator side which constitutes a motor, as for a wiring top, an end is grounded through a power source VCC and the actuation currents IL1 and IL2 flow complementary for every 180 electrical angles. A structure top fixes in the predetermined location by the side of the stator which constitutes a motor, as for a wiring top, it connects between a power source VCC and touch-down, a power source is supplied, and a hall device (3) outputs sinusoidal signal H+ of an opposite phase, and H- respectively according to a stator and the relative location of Rota. Amplifier (4) compares sinusoidal signal H+ with sinusoidal signal H- of an opposite phase, and outputs a square wave signal. A control circuit (5) creates the square wave signal B of an opposite phase based on the square wave signal A outputted from amplifier (4), and after it carries out current amplification of both square wave signals A and B, it outputs it. When it connects between the other end of a drive coil (1), and touch-down where Darlington connection is carried out, and the high level of the square wave signal A is supplied to the base of an NPN mold transistor (6), an NPN mold transistor (6) and (7) turn on an NPN mold transistor (8) and (7), and they pass the actuation current IL 1 to a drive coil (1). Similarly, when it connects between the other end of a drive coil (2), and touch-down where Darlington connection is carried out, and the high level of the square wave signal B is supplied to the base of an NPN mold transistor (6), an NPN mold transistor (8) and (9) turn on an NPN mold transistor (8) and (9), and they pass the actuation current IL 2 to a drive coil (2). And when the actuation currents IL1 and IL2 flow by turns to a drive coil (1) and (2), a motor rotates.
[0004]
[Problem(s) to be Solved by the Invention] Drawing 6 is the wave form chart showing said actuation currents IL1 and IL2. The actuation currents IL1 and IL2 (=IL) are expressed with a degree type.
[0005] IL= (VCC-Vsat-Ec)/RL, however VCC [... Since the reverse electromotive voltage Ec becomes small near / T / just before the point which switches the actuation currents IL1 and IL2 during the resistance component of a drive coil (1) and (2), now a revolution of a motor switching / phase /, the actuation current IL becomes large.] .... Supply voltage Vsat -- Saturation voltage Ec of an actuation transistor (7) and (9) ... Reverse electromotive voltage RL However, with the actuation current IL near [T] just before the point switching [phase], the running torque generating effectiveness of a motor was bad from the first, and there was a problem which the magnitude of the actuation current IL suffers misfortune, and the running torque of a motor is changed in connection with the abrupt change of the actuation current IL, and induces the oscillating sound of a motor. Moreover, when the actuation currents IL1 and IL2 were passed to a phase switch and coincidence a drive coil (1) and (2), there was a problem used

as the factor which the reactive current influences and controls the actuation effectiveness of a motor.
[0006] Then, this invention aims at offering the motorised circuit which realizes the silence and the improvement in actuation effectiveness in a motor.
[0007]
[Means for Solving the Problem] This invention is created in order to solve said trouble, and it is based on the sinusoidal signal which a hall device generates according to the stator which constitutes a motor, and the relative location of Rota. In the motorised circuit which has the 1st actuation transistor and the 2nd actuation transistor which drive the 1st coil and the 2nd coil complementary The saw-tooth wave signal and reference voltage which change to an one direction at the time of actuation of said 1st and 2nd coils, and change in the other directions at the time of a phase switch of said 1st and 2nd coils are compared. A means to generate the 1st actuation off signal in near the second half near the first half of the point of said 1st and 2nd coils switching [phase]. The full wave signal which carried out full wave conversion of said sinusoidal signal is compared with the sample hold signal which carried out sample hold of the attenuation signal which attenuated said full wave signal to the timing of said 1st actuation off signal. A means to generate the 2nd actuation off signal near the side which said 1st actuation off signal in the point of said 1st and 2nd coils switching [phase] does not generate. Said 1st and 2nd actuation off signal is added, and it is characterized by having a means to output the signal which carries out simultaneous OFF of said 1st and 2nd actuation transistor near the switching [phase] point order half of said 1st and 2nd coils.
[0008] Moreover, it is based on the sinusoidal signal which a hall device generates according to the stator which constitutes a motor, and the relative location of Rota. In the motorised circuit which has the 1st actuation transistor and the 2nd actuation transistor which drive the 1st coil and the 2nd coil complementary The control pulse generating circuit which generates a control pulse to the timing which switches actuation of said 1st and 2nd coils based on said sinusoidal signal, The saw-tooth wave signal generating circuit which discharges when it charges according to a predetermined time constant and said control pulse is supplied, and generates a saw-tooth wave signal, The 1st comparison circuit where only predetermined width of face outputs the 1st actuation off signal of the logical level of one side from the event of comparing reference voltage higher than the minimum electrical potential difference of said saw-tooth wave signal and said saw-tooth wave signal, and said saw-tooth wave signal discharging, To the attenuation signal of the absolute value signal of said sinusoidal signal, perform sample hold by **** of said 1st actuation off signal, and the amplitude at that time is held. Then, the sample hold circuit which outputs a trapezoidal wave signal by making said maintenance amplitude into zero by **** of said 1st actuation off signal, The 2nd comparison circuit where only predetermined width of face outputs the 2nd actuation off signal of the logical level of one side before the event of comparing said absolute value signal and said trapezoidal wave signal, and said saw-tooth wave signal discharging, Said 1st and 2nd actuation off signal is added, and it is characterized by having the adder circuit which outputs the signal for carrying out simultaneous OFF of said 1st and 2nd actuation transistor near the switching [phase] point order half of said 1st and 2nd coils.
[0009]
[Embodiment of the Invention] The detail of this invention is concretely explained according to a drawing.
[0010] Drawing 1 is the circuit block diagram showing the motorised circuit of this invention. In addition, the same number is described in the same component as drawing 5 in drawing 1 , and the explanation is omitted. Moreover, drawing 2 is the wave form chart showing actuation of drawing 1 .
[0011] In drawing 1 , a control circuit (10) carries out conversion of waveform of the sinusoidal signal outputted from amplifier (4) to the square wave signal A. The square wave signal A is supplied and a control pulse generating circuit (11) generates control pulse B at the standup [of the square wave signal A], and falling event. Resistance (12) and a capacitor (13) constitute a time constant circuit, and charge according to the resistance of resistance (12), and the capacity of a capacitor (13). A charge-and-discharge control circuit (14) discharges the stored charge of

a capacitor (13), when it connects with a control pulse generating circuit (11) and control pulse B is supplied. In addition, at the time of discharge, the minimum value of the stored charge of a capacitor (13) is restricted to an electrical potential difference V1, and does not become less than [electrical-potential-difference V1]. Therefore, from the node of resistance (12) and a capacitor (13), the saw-tooth wave signal C which discharges to the minimum electrical potential difference V1 for every phase switch occurs. The series connection of resistance (15) and the thermistor (16) is carried out between a power source VCC and touch-down, and they generate the electrical potential difference V2 higher than an electrical potential difference V1 from the connection middle point. The 1st comparator (17) compares the saw-tooth wave signal C with an electrical potential difference V2. Namely, an electrical potential difference V2 is set to a period higher than the saw-tooth wave signal C being high-level, and, as for the 1st comparator (17), outputs the 1st comparison signal D (the 1st actuation off signal) with which, as for a period lower than the saw-tooth wave signal C, an electrical potential difference V2 serves as a low level. The high-level period of the 1st comparison signal D becomes so long that it is so short [that the ambient temperature of a thermistor (16) is high] low.

[0012] An absolute-value circuit (18) outputs the absolute value signal E which took the absolute value bordering on the amplitude middle point to sinusoidal signal H+ which a hall device (3) outputs, and H-. Amplifier (19) outputs the attenuation signal F which attenuated the absolute value signal E by the attenuation factor which becomes settled in the resistance of resistance (20) and (21). As for the absolute value signal E and the attenuation signal F, common direct-current bias is given by the reference supply (32). In addition, the attenuation signal F is a wave in case control pulse B and the comparison signal D do not act on the sample hold circuit mentioned later. In falling of the comparison signal D, a sample hold circuit (22) carries out sample hold of the attenuation signal F, holds it, and outputs after that the trapezoidal wave signal G to which the attenuation signal F was dropped to the minimum electrical potential difference of the absolute value signal E in the standup of the comparison signal D. The 2nd comparator (23) compares the absolute value signal E with the trapezoidal wave signal G, the trapezoidal wave signal G is set to a period higher than the absolute value signal E being high-level, and the trapezoidal wave signal G outputs the 2nd comparison signal H (the 2nd actuation off signal) with which a period lower than the absolute value signal E serves as a low level. The 2nd comparison signal H generates only the predetermined width of face before a phase switch of a drive coil (1) and (2). An OR circuit (41) adds the 1st comparison signal D and the 2nd comparison signal H, and outputs the addition signal K for carrying out simultaneous OFF of the 1st and 2nd actuation transistor (7) and (8) near the switching [phase] point order half of a drive coil (1) and (2). In addition, since the standup of the 1st comparison signal D and falling of the 2nd comparison signal H are based on control pulse B when the 1st and 2nd comparison signals D and H are added, a chattering does not happen by the junction of the standup of the 1st comparison signal D, and falling of the 2nd comparison signal H. The addition signal K is supplied and a control circuit (10) outputs the 2nd driving signal J for turning on the 1st driving signal I and the 2nd actuation transistor (9) for turning on the 1st actuation transistor (7) based on the addition signal K. From this, to a drive coil (1) and (2), the actuation currents IL1 and IL2 flow, and a motor rotates.

[0013] As mentioned above, [near the first half of the point switching / (a) phase], since it can do with zero before being influenced [to which the reverse electromotive voltage Ec becomes small about the actuation currents IL1 and IL2], the actuation currents IL1 and IL2 can prevent the inconvenience which falls from high level rapidly, and the silence of a motor of them is attained.

[0014] (b), when the amplitude of sinusoidal signal H+ and H- is changed in connection with property dispersion of a hall device (3) Even if it is the case where the period of sinusoidal signal H+ and H- is changed with change to the rotational speed of a motor Since the simultaneous "off" period of the 1st and 2nd actuation transistor (7) near the switching [phase] point order half and (9) is made as it is fixed, and the steep standup of the actuation current IL can be prevented, it is suitable for silence of an adjustable speed motor.

[0015] (c) [near the second half of the point switching / phase], since the actuation currents

IL1 and IL2 are succeedingly made with zero from near in the first half, the reactive current can be disregarded and decline in the actuation effectiveness of a motor can be prevented.

[0016] (d) In order to create the trapezoidal wave signal G from the attenuation signal F, even if the width of face of the 1st comparison signal D is influenced of the change in resistance of the thermistor (16) accompanying ambient-temperature change, it surely generates and the 2nd comparison signal H can prevent generating of the noise accompanying fluctuation and it of the running torque of a motor.

[0017] The said operation effectiveness is done so.

[0018] Now, signal output actuation is explained using 1 operation circuit about the saw-tooth wave signal C of drawing 1 , and the trapezoidal wave signal G.

[0019] Drawing 3 is the circuit diagram showing one example of a charge-and-discharge control circuit (14). Drawing 3 fluctuates the base electrical potential difference of the transistor (25) of this potential, and the emitter electrical potential difference of a transistor (26) mutually according to turning on and off of a transistor (24).

[0020] In drawing 3 , when control pulse B does not occur, a transistor (24) turns off and the base electrical potential difference of a transistor (25) and the emitter electrical potential difference of a transistor (26) turn into the electrical potential difference Vmax which subtracted the ends electrical potential difference of resistance (28) from ***** VCC. Therefore, a capacitor (13) charges with the time constant which becomes settled by the resistance of resistance (12), and the capacity of a capacitor (13), and the terminal voltage of a capacitor (13) rises. In addition, although the generating period of control pulse B changes according to the engine speed of a motor, said time constant is set as the value which does not reach an electrical potential difference Vmax, as the charge electrical potential difference of a capacitor (13) is the generating period of control pulse B. On the other hand, when control pulse B occurs, a transistor (24) turns on and the base electrical potential difference of a transistor (25) and the emitter electrical potential difference of a transistor (26) turn into the partial pressure electrical potential difference V1 (<Vmax) of resistance (28) and (29). At this time, since the non-grounded side electrical potential difference of a capacitor (13) is higher than an electrical potential difference V1, the stored charge of a capacitor (13) discharges to an electrical potential difference V1 through a transistor (27). This actuation is repeated and the saw-tooth wave signal C occurs. Drawing 4 is amplifier (19), a sample hold circuit (22), and the circuit diagram showing one example of a comparator (23).

[0021] In drawing 4 , amplifier (19) has established the serial object which changes from resistance (31) and reference voltage (32) to the input section of the absolute value signal E. Therefore, electrical-potential-difference conversion of the absolute value signal E expressed with the current is carried out by resistance (31) on the basis of the minimum electrical potential difference V3. The absolute value signal E by which electrical-potential-difference conversion was carried out is decreased by attenuation factor Ro/(Ra+Rb) determined with each resistance Ra and Rb of resistance (20) and (21) through an internal differential amplifying circuit and current Miller circuit, and turns into the attenuation signal F. Here, a sample hold circuit (22) intervenes between the output of amplifier (19), and the input of a comparator (23). In a sample hold circuit (22), if control pulse B occurs, an NPN mold transistor (33) will turn on and the stored charge of a capacitor (34) will discharge. Since it becomes high-level at this time after control pulse B generates the 1st comparison signal D until the saw-tooth wave signal C exceeds an electrical potential difference V2, ON and a transistor (36) turn off and, as for a capacitor (34), a transistor (35) charges through diode (37). Then, if the 1st comparison signal D changes to a low level, it will be in the condition that all the currents of a current source (38) flowed the collector emitter way of a transistor (38) since OFF and a transistor (36) turned [a transistor (35)] on, and the terminal voltage of a capacitor (34) was held by a capacitor (34) suspending charge. In addition, the transistor (39) by which Darlington connection was carried out, and (40) are the things for stopping the amount of discharge of stored charge to the minimum, when a capacitor (34) is in an electrical-potential-difference maintenance condition. The trapezoidal wave signal G occurs from this.

[0022]

[Effect of the Invention] Since according to this invention it can do with zero before being influenced [to which a reverse electromotive voltage becomes small about a coil current] [near the first half of the point of the 1st and 2nd coils switching / phase], a coil current can prevent the inconvenience which falls from high level rapidly, and the silence of a motor of it is attained. Moreover, since the simultaneous "off" period of the 1st and 2nd actuation transistor near the switching [phase] point order half is made as it is fixed and the steep standup of a coil current can be prevented even if it is the case where the period of a sinusoidal signal is changed with change to the rotational speed of a motor when the amplitude of a sinusoidal signal is changed in connection with property dispersion of a hall device or, it is suitable for silence of an adjustable speed motor. Moreover, [near the second half of the point switching / phase], since a coil current is succeedingly made with zero from near in the first half, the reactive current can be disregarded and decline in the actuation effectiveness of a motor can be prevented.

[Translation done.]